

**NH31A-3852 Long-Term Soil Gas Surveys in the Northern Part of the Modena Province Pre, During and After the 2012 Seismic Sequence**

Session Interdisciplinary Study of Pre-earthquake Processes: Observation, Validation, Modeling, and Forecasting II Posters

Three geochemical surveys of soil gas ( $\text{CO}_2$  and  $\text{CH}_4$  flux measurements, He,  $\text{H}_2$ ,  $\text{CO}_2$ ,  $\text{CH}_4$  and  $\text{C}_2\text{H}_6$  concentrations) and isotopic analyses ( $\delta^{13}\text{C}-\text{CH}_4$ ,  $\delta\text{D}-\text{CH}_4$ ,  $\delta^{13}\text{C}-\text{CO}_2$ ) were carried out as part of a feasibility study for a natural gas storage site in the Modena Province (Northern Italy), during the 2006-2009 period. In May-June 2012, a seismic sequence (main shocks of ML 5.9 and 5.8) was occurred closely to the investigated area. Chemical and isotopic analysis were repeated in May 2012, September 2012, June 2013 and July 2014. In the 2006-2009 period, at the pre-seismic conditions, chemical composition of soil gas showed that the southern part of the studied area is  $\text{CH}_4$ -dominated, whereas the northern part is  $\text{CO}_2$ -dominated. Relatively anomalous fluxes and concentrations were recorded with a spotted areal distribution. Anyway,  $\text{CO}_2$  and  $\text{CH}_4$  values are within the typical range of vegetative and of organic exhalation of the cultivated soil.

2012-2013 soil gas results show  $\text{CO}_2$  values essentially unvaried with respect to pre-earthquake surveys, while the 2014 values highlight an increasing of  $\text{CO}_2$  flux in the whole study area. On the contrary,  $\text{CH}_4$  values seem to be on average higher after the seismic sequence, although with a decreasing trend in the last survey (2014).

Isotopic analysis were carried out only on samples with anomalous values. The  $\delta^{13}\text{C}-\text{CO}_2$  value suggests a prevalent shallow origin of  $\text{CO}_2$  (i.e. organic and/or soil-derived) probably related to anaerobic oxidation of heavy hydrocarbons. Methane isotopic data ( $\delta^{13}\text{C}-\text{CH}_4$ ) indicate a typical biogenic origin (i.e. microbial hydrocarbon production) of the  $\text{CH}_4$ , as recognized elsewhere in the Po Plain and surroundings.

Obtained results highlight a different  $\text{CO}_2$  and  $\text{CH}_4$  behaviour before, during and after the seismic events. These variations could be produced by increasing of bacterial (e.g. peat strata) and methanogenic fermentation processes in the first meters of the soil. No hints of deep degassing can be inferred for the study area after the earthquake, as suggested by isotopic analysis.

These achieved outcomes constitute the starting point for subsequent geochemical surveys, in order to assess the temporal variations and to better understand the geochemical processes related to the seismic sequence.

**Authors**

- Alessandra Sciarra - National Institute of Geophysics and Volcanology
- Barbara Cantucci - National Institute of Geophysics and Volcanology
- Gianfranco Galli - National Institute of Geophysics and Volcanology
- Daniele Cinti - National Institute of Geophysics and Volcanology
- Fedora Quattrocchi - National Institute of Geophysics and Volcanology